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How does the World Google the Internet, Anxiety and Happiness?

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Abstract

This paper investigates how the world uses Google, the most popular search engine, to look for information about the "Internet" as well as two symptoms of emotional well-being, namely, "anxiety" and "happiness." Data corresponding to 202 countries were collected for a period of five years from 2013 to 2017 using Google Trends, a free surveillance tool that reports data from the search engine. The search volume of "Internet" was positively correlated with that of "anxiety" as well as "happiness." Furthermore, the paper analysed if the search volumes correlated with actual emotional well-being measured using the World Happiness Index provided by the United Nations (UN), and the Life Satisfaction Index provided by the Organisation for Economic Co-operation and Development (OECD). The search volume of "anxiety" showed positive correlations with both the indices. The results are discussed, and new directions for future research are identified.

Keywords: anxiety, Google, happiness, search engine, well-being

Introduction

This paper draws inspiration from two seemingly disparate but potentially relatable research areas that have yet to find much intersection. The first is on the link from the Internet to emotional well-being while the second is on the relevance of Google's search queries to obtain a glimpse of public attention.

With respect to the first research area, the pervasiveness of digital technologies and online platforms has prompted cyberpsychology scholars to understand how the Internet is associated with emotional well-being. Particularly, the theory of problematic Internet use argues that problematic psychosocial conditions lead individuals to excessive and compulsive use of technology that in turn exacerbates the problem.[1] Consistent with the theory, negative emotional symptoms such as anxiety and depression are known to predict people's willingness to go online that in turn determines overuse of technology.[2-4] When people are emotionally deflated, they deem the online environment as a relatively safer place than the offline setting.[5]

Research has also started to illuminate the relation between the Internet and positive emotional symptoms such as happiness and satisfaction. Specifically, the compensatory Internet use theory assumes that the use of technology can alleviate problematic psychosocial conditions, and contribute to a positive mental state.[6] In line with the theory, Internet use has been shown to predict individuals' happiness.[7,8] In fact, the gradual and supposedly-inevitable decline in subjective well-being throughout adult life is possible to slow down through regular Internet use.[9] Perhaps expectedly, there is a renewed sense of urgency in conceptualising cyberhappiness—the extent to which an Internet user is happy.[10]

The second research area that inspires this paper pertains to Google's search queries. Google has firmly cemented its place as one of the leading search engines of the world over the last few decades. In 2017 alone, it averaged a net share of close to 75% overall and more

than 90% when considering the use of search engines from mobile devices. The volume of daily searches on Google was about 3.5 billion worldwide.[11] Such staggering numbers for the popular search engine are unforeseeable to plateau out any time soon.

When people are curious to know about a topic, Google very often comes to their rescue. They key in what are known as search queries to meet their information need. Given that the queries are self-initiated, they serve as proxies of public attention.[12] The algorithmic black-box notwithstanding, queries have been used to get insights into public attention on a wide range of topics such as automobiles,[13] unemployment,[14] and anti-smoking campaigns.[15] More pertinently, they have been used to study how people search about health and suicide.[16,17]

Guided by the areas of research highlighted above, this paper makes two assumptions. First, the use of the Internet is correlated with people's emotional well-being. In an age when the use of the Internet is ubiquitous, there is bound to be high curiosity about the Internet. And if Internet use is correlated with emotional well-being, there should arguably be high curiosity about emotional well-being too. This leads to the second assumption: To satisfy curiosity and meet information need, people would rely on Google to search not only about the Internet but also about emotional well-being.

These assumptions set up an interesting context to investigate the following research questions (RQs):

RQ 1: What queries do people use to search about the Internet and emotional well-being?

RQ 2: To what extent does search volume about the Internet correlate with that about emotional well-being?

RQ 3: Does search volume about the Internet or emotional well-being correlate with actual emotional well-being?

This paper is timely for two reasons. First, while the use of search query data has started to bloom in recent years,[12,18] its applicability has not yet been extended to the research area of Internet use and emotional well-being. Nonetheless, there is evidence that search query data help predict actual trends of dengue fever[19] and stroke.[20] Therefore, they seem to have the potential to shed interesting light on people' emotional well-being.

Second, this paper makes a modest attempt to bridge the chasm between two research areas. One deals with the link from Internet use to emotional well-being, and is commonly explored by cyberpsychology scholars.[21,22] The other focuses on online information seeking, and is generally examined by information scientists.[23,24] Visualising these research areas as mosaic pieces, this paper represents one of the earliest studies to examine Internet use and emotional well-being from the perspective of online information seeking. In so doing, it also calls for more similar interdisciplinary efforts.

Methods

This paper obtained data on Google's search queries from Google Trends. It is a free surveillance tool that reports data from the search engine, and has been used widely in previous research.[12-17] It allows retrieving data about how a particular region of the world used Google's search engine to seek information about a given topic during a specific time period. Commonly used search queries related to the topic are also displayed.

Choice of seed queries

The choice of seed queries about the Internet and emotional well-being was crucial. For this purpose, a multi-pronged approach was adopted. For one, keywords indicated in papers that touch on the themes of the Internet and emotional well-being were reviewed. Relevant keywords that were identified include "Internet," "smartphone," "technology,"

"addiction," "anxiety," "loneliness," "depression," "stress," "happiness," "satisfaction," "mental health," and "well-being."

Next, as a pilot study, the researcher engaged in informal conversation separately with 10 individuals contacted using snowballing (4 females, age ranged from 28 to 55 years). They were regular Internet users, used Google as their de facto search engine with over 100 searches per week, had accounts with multiple social media platforms, and straddled across seven nationalities. They were asked that if they had to use Google to search about the Internet and emotional well-being, which of the identified keywords would they use as search queries and why.

The top three suggested queries were "Internet" (mentioned by all the 10 individuals), "anxiety" (mentioned by 5 individuals), and "happiness" (mentioned by 6 individuals). Interestingly, most of the individuals (seven out of 10) indicated Internet and at least one negative emotional symptom coupled with at least one positive emotional symptom. They pointed that they would search about both extremes to meet their information need holistically. Therefore, this paper uses "Internet," "anxiety" and "happiness" as the three seed queries to address the RQs.

Data collection strategy

The goal was to collect data for all countries in the world as granularly as possible. For this purpose, several country-wise listings were trawled.[25,26] However, owing to insufficient search volume, Google Trends failed to return results for several countries. Examples include the likes of Nauru, Niue, North Korea, Tuvalu and Vatican City. The final analyses were therefore based on data retrievable for 202 countries.

The data were collected for the last five years starting from 2013 till 2017. A period of five years was chosen to enhance robustness of the analyses. If search volume of "Internet"

correlate with that of “anxiety” or “happiness” on only some years, the correlations could be dismissed as coincidental and spurious. However, if the correlations withstand the litmus test of time across the five-year period, they would inspire greater confidence in the validity of the results.

For each of the 202 countries, data on the seed queries “Internet,” “anxiety” and “happiness” per year (2013-2017) were retrieved. In this vein, it should be pointed that Google transforms the raw search volume data before making them available via Google Trends. Hence, the search volumes are not readily comparable unless an irrelevant query is used as a baseline. In particular, “IT Job” was used as the baseline query for comparison because its suitability has been empirically demonstrated.[12]

Data analysis

With respect to RQ 1, this paper reports the top 10 queries related to the three seed queries “Internet,” “anxiety” and “happiness” worldwide from 2013 to 2017. The purpose was to offer a qualitative treatment of the queries. With respect to RQ 2, Pearson’s correlation analyses were conducted with the search volumes of the queries annually.

To address RQ 3, volumes of search about the Internet and emotional well-being were corroborated with the World Happiness Index provided by the United Nations (henceforth, referred as the UN Index) and the Life Satisfaction Index provided by the Organisation for Economic Co-operation and Development (henceforth, referred as the OECD Index). These indices have been used in previous research as proxies of people’s emotional well-being.[27,28] Moreover, the use of more than one index enhances the analytical robustness.

Both the UN Index and the OECD Index are measured through surveys asking people about their happiness. They apparently have nothing to do with the ways in which people use a search engine. Therefore, exercising caution, this paper refrains from hypothesising that

they would be correlated with the search volumes. Nonetheless, if the indices end up being correlated with people's Googling habits, it would be a noteworthy result warranting further investigation.

RQ 1 and RQ 2 were addressed based on the worldwide data of 202 countries throughout the five-year period. However, the scope of RQ 3 was trained on a smaller pool of data. This was unavoidable because the UN Index was available for 2016 and 2017 corresponding to 153 of the 202 countries. The OECD Index could be successfully retrieved for 2013, 2014, and 2015 corresponding to 35 countries as well as for 2016 and 2017 corresponding to 38 countries.

Results

With respect to RQ 1, Table 1 lists the top 10 queries related to the seed queries of "Internet," "anxiety" and "happiness" worldwide from 2013 to 2017. The non-English queries were deciphered using the online translation tool Google Translate. Some of the queries used were essentially the same with each other. Examples include the following two anxiety-related queries: "essential oils for anxiety" and "essential oil for anxiety."

The queries reflected both breadth and depth.[12] Breadth suggests that people will use queries that are related to facets different from the topic per se while depth denotes that people will use queries to know about the topic in details.

For example, among the top 10 Internet-related queries, "HalkBank internet branch" and "vietcombank internet banking" reflect breadth. They are more about Internet banking rather than the Internet. In contrast, the queries "hola better internet" and "private internet access" reflect depth. The first indicates concern about better Internet access from Hola, a collaborative peer-to-peer Internet service. The next specifically seeks information about accessing the Internet privately.

Similarly, among the top 10 anxiety-related queries, “anxiety gif” and “anxiety meme” reflect breadth. In contrast, “anxiety icd 10” and “essential oils for anxiety” reflect depth. In the former, ICD-10 pertains to a generalised anxiety disorder. The latter is about the use of essential oils to reduce anxiety.

However, among the top 10 happiness-related queries, there seemed to be more breadth than depth. Queries such as “happiness charge procure,” “fallout 4 happiness,” and “red velvet happiness” all reflect breadth, but not depth. “HappinessCharge PreCure!” is the name of a television series. “Fallout 4” is a role-playing video-game. “Red Velvet” refers to a group of musicians. In these instances, the word “happiness” seems to have been a homonym that was not possible for search engine algorithms to flag out.

Table 1. TOP 10 QUERIES RELATED TO INTERNET, ANXIETY AND HAPPINESS

Top 10 queries worldwide from 2013 to 2017 in decreasing order of search volume		
Internet	**Anxiety**	**Happiness**
kaspersky internet security 2014	anxiety meaning in urdu	happiness charge procure
kaspersky internet security 2015	anxiety icd 10	happiness シェネル (happiness Shennell)
hola better internet	high functioning anxiety	fallout 4 happiness
kaspersky internet security 2017	anxiety meaning in hindi	happiness therapy streaming
vcb internet banking	depression anxiety stress test	red velvet happiness
halkbank internet şubesi (HalkBank internet branch)	anxiety gif	increase happiness fallout 4
mandiri internet bisnis (standalone internet business)	essential oils for anxiety	max happiness fallout 4
spectrum internet	essential oils	fallout 4 how to increase happiness
private internet access	essential oil for anxiety	settlements fallout 4
vietcombank internet banking	anxiety meme	how to get 100 happiness fallout 4

The results of RQ 2 are summarised in Table 2. The means and the standard deviations suggest that “Internet” was used as a search query more widely than either

"anxiety" or "happiness" across the 202 countries throughout the five-year period. The search volume of "Internet" was significantly correlated with that of "anxiety" (2013: r=0.17, p<0.05; 2014: r=0.17, p<0.05; 2015: r=0.18, p<0.05; 2016: r=0.17, p<0.05; 2017: r=0.15, p<0.05). Moreover, it was significantly correlated with that of "happiness" (2013: r=0.33, p<0.001; 2014: r=0.34, p<0.001; 2015: r=0.28, p<0.001; 2016: r=0.24, p<0.001; 2017: r=0.22, p<0.01). These results confirm that the volume of search about the Internet correlated with that about emotional well-being.

Interestingly, the search volume of "anxiety" was also significantly correlated with that of "happiness" (2013: r=0.51, p<0.001; 2014: r=0.60, p<0.001; 2015: r=0.52, p<0.001; 2016: r=0.44, p<0.001; 2017: r=0.50, p<0.001). This serendipitous result lends support to the point raised in the pilot study conversations mentioned earlier: Most people interested to know about emotional well-being would search about both positive and negative emotional symptoms (e.g., happiness and anxiety) to meet their information need holistically.

Table 2. CORRELATIONS AMONG THE QUERIES

Year	Queries	Mean	SD	Internet (1)	Anxiety (2)	Happiness (3)
2013	Internet (1)	62.55	21.64	1		
(N=202)	Anxiety (2)	1.54	2.37	**0.17***	1	
	Happiness (3)	2.89	3.31	**0.33*****	**0.51*****	1
2014	Internet (1)	63.22	20.08	1		
(N=202)	Anxiety (2)	1.83	2.59	**0.17***	1	
	Happiness (3)	3.01	2.99	**0.34*****	**0.60*****	1
2015	Internet (1)	62.60	21.06	1		
(N=202)	Anxiety (2)	2.28	3.22	**0.18***	1	
	Happiness (3)	3.29	3.52	**0.28*****	**0.52*****	1
2016	Internet (1)	62.62	19.82	1		
(N=202)	Anxiety (2)	3.04	4.12	**0.17***	1	
	Happiness (3)	3.63	4.23	**0.24*****	**0.44*****	1
2017	Internet (1)	62.67	19.61	1		
(N=202)	Anxiety (2)	3.67	4.71	**0.15***	1	
	Happiness (3)	4.08	4.84	**0.22****	**0.50*****	1

Note. *** p < 0.001, ** p < 0.01, * p < 0.05.

The results of RQ 3 are summarised in Table 3 (with regards to the UN Index) and Table 4 (with regards to the OECD Index). The UN Index showed statistically significant correlations with the search volume of "Internet" (2016: r=0.53, p<0.001; 2017: r=0.55, p<0.001), "anxiety" (2016: r=0.38, p<0.001; 2017: r=0.39, p<0.001), and "happiness" (2016: r=0.20, p<0.05; 2017: r=0.17, p<0.05).

Table 3. CORRELATIONS BETWEEN THE QUERIES AND THE UN INDEX

Year	UN Index/Queries	Mean	SD	Correlations with the UN Index
2016	UN Index	5.38	1.15	1
(N=153)	Internet	70.37	13.02	**0.53*** **
	Anxiety	3.08	4.21	**0.38*** **
	Happiness	4.10	4.55	**0.20***
2017	UN Index	5.35	1.14	1
(N=153)	"Internet"	70.14	13.76	**0.55*** **
	"Anxiety"	3.65	4.78	**0.39*** **
	"Happiness"	4.52	5.21	**0.17***

Note. *** p < 0.001, * p < 0.05.

Moreover, the OECD Index was significantly correlated with the search volume of "anxiety" (2013: r=0.35, p<0.05; 2014: r=0.37, p<0.05; 2015: r=0.42, p<0.05; 2016: r=0.40, p<0.05; 2017: r=0.41, p<0.05). However, the index failed to show any statistically significant correlations with the search volume of either "Internet" or "happiness" throughout the five-year period.

The significant results for "Internet" and "happiness" with respect to the UN Index but non-significant results for the OECD Index could possibly be vestige of the smaller sample size in the latter. Nonetheless, even following a conservative approach in drawing inferences, the finding that the search volume of "anxiety" correlated with both the UN Index and the OECD Index is difficult to simply sweep under the carpet.

Table 4. CORRELATIONS BETWEEN THE QUERIES AND THE OECD INDEX

Year	OECD Index/Queries	Mean	SD	Correlations with the OECD Index
2013	OECD Index	6.61	0.86	1
(N=35)	Internet	82.00	8.89	-0.09
	Anxiety	3.03	4.12	**0.35***
	Happiness	4.91	5.04	0.11
2014	OECD Index	6.64	0.91	1
(N=35)	Internet	77.54	12.61	0.13
	Anxiety	3.20	4.29	**0.37***
	Happiness	4.11	2.75	0.28
2015	OECD Index	6.60	0.79	1
(N=35)	Internet	79.54	9.58	-0.02
	Anxiety	4.00	5.25	**0.42***
	Happiness	4.34	3.83	0.13
2016	OECD Index	6.52	0.77	1
(N=38)	Internet	78.27	9.07	0.14
	Anxiety	5.35	6.79	**0.40***
	Happiness	5.00	5.95	0.10
2017	OECD Index	6.55	0.78	1
(N=38)	Internet	78.97	9.55	0.01
	Anxiety	6.05	7.22	**0.41***
	Happiness	5.05	6.47	0.05

Note. * $p < 0.05$.

Discussion

The paper gleaned the following major findings: The search volume of "Internet" was positively correlated with that of both "anxiety" and "happiness". This adds a new perspective to the cyberpsychology literature that has long suggested the link between use of the Internet and emotional well-being.[2,4,7,8] As new forms of Internet applications make rapid inroads to human life, they tickle people's curiosity. In consequence, people turn to Google's search engine to meet their information need.[29] The sustained use of the Internet also affects their emotional well-being as suggested by the theory of problematic Internet use and the compensatory Internet use theory.[1,6] Hence, they perhaps again revert to Google to search about both negative and positive emotional symptoms. This could be why the search volume of "anxiety" was also positively correlated with that of "happiness." It seems that the ways in which the search engine is used can offer valuable insights into people's mental state.

Moreover, the search volume of "anxiety" was positively correlated with the UN Index for about 150 countries as well as the OECD Index for about 40 countries. As revealed in Table 1, the top 10 queries related to anxiety had considerable depth rather than breadth. Given that there were apparently no homonyms, the statistically significant correlations cannot be easily ruled out as fortuitous.

It is noteworthy for policymakers that how residents of a country search online about anxiety seems to predict the nation's life satisfaction indices. In particular, the higher the search volume of "anxiety," the greater was the score of the life satisfaction indices and vice-versa. A plausible explanation is that people who search the Internet about anxiety believe they can successfully deal with the negative emotion owing to the truckloads of information they receive. This perceived self-efficacy could make them affirmative about their well-being.[30] When such people are surveyed about life satisfaction, the score of the indices are unsurprisingly boosted. While psychologists have long advocated that the search for happiness leads to unhappiness,[31,32] this paper hints at the possibility of the converse to be true as well—the search for anxiety leads to happiness. Further research is needed to validate this new prospect.

The paper opens up a few other directions for future research. For one, to better establish the relationship between people's emotional well-being and online search behaviour, cyberpsychology scholars could explore research methods such as diary studies. Nuances in participants' log of their search queries could be analysed as a function of mood. The role played by different facets of anxiety such as state anxiety and trait anxiety could also be investigated.[33]

To positive psychology scholars, this paper poses an intriguing question: Can the ways in which people use search engines and input search queries cause individuals to be happy? If such a cause-and-effect relationship is established, it might pave the way to

develop prescriptive guidelines on how to somewhat alleviate the negative emotional impact of the Internet.[1]

Furthermore, if search behaviour can predict on the fly that the individual searching is mentally devastated, the efficacy of possible real-time intervention strategies could be explored. Such research efforts in the long run might even offer hints on how to curtail suicides. After all, using search engines to look for information on ways to commit suicide is quite common.[16]

These findings notwithstanding, a limitation in this paper deserves a mention. The presence of homonyms in queries represented noise in the data. For example, the exact search volume of the positive emotional symptom "happiness" was not possible to separate from that about the television series "HappinessCharge PreCure!" In the spirit of interdisciplinarity, the paper invites computer and information scientists as well as linguists to hone search engine algorithms so as to better address the problem of homonyms. A relatively homonym-free search engine space would not only enhance the precision of research efforts similar to the current paper but also improve people's information seeking experience.

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